UNIVERSITI TEKNOLOGI MARA

ASSESSMENT OF RADIONUCLIDES AND HEAVY METALS DISTRIBUTION AND INVENTORIES IN KUALA SELANGOR COASTAL AREA

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA (UiTM), regulating the conduct of my study and research.

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ABSTRACT

This study was carried out to determine the distribution of radionuclides and selected heavy metals in surface seawater, to determine the sedimentation rate, to determine the distribution and inventories of naturally occurring radioactive material (NORM) and selected heavy in sediment and finally to calculate the radiation hazard index (H_{ex}) and assess level of heavy metal contamination in sediment using geo-accumulation index (I_{geo}). The study area was divided into four sections which covered 30 kilometers along Kuala Selangor coastal area and estuary and about 2 kilometers into Selangor River. The determination of U and Th in seawater did not showed any significant trend along the coastal area. Besides, no significant relationship were observed between U and Th concentrations and value of salinity in the samples which may due to low salinity oceanic environments that occurred in the estuaries and makes the behavior seems more variable. Besides, the concentrations of heavy metals (Pb, Cd and Ni) were varied between stations and most of the stations fairly contaminated with Pb. In addition, the mean concentrations of heavy metals in surface water in Section 4 are well below the Malaysian Drinking Water Quality Standard. The sedimentation rate value in the study area were closer with other study which is in the ranged of 0.1547 - 0.3397 cm/year and most of the stations in Section 3 showed high sedimentation rate than other sections which may due to an increase in land clearing activities at the catchment area of Sungai Selangor. The distribution of NORM in most of the cores showed that it was in the mixing layer based on the inconsistent variation of the activity concentration of NORM. Furthermore, total inventories of ^{226}Ra, ^{228}Ra and ^{40}K in the sediment core were not differ very much between the stations. However, station SS3 in Section 4 displayed the highest inventories of ^{226}Ra and ^{228}Ra which may suggested that the input of Ra from the past mining activities was significant in the area. By comparing the heavy metal concentration in sediment with the average shale standard and New York Sediment quality Guideline, most of the stations in Section 3 and Section 4 exceed the standard. This may suggest that the anthropogenic activities and complex processes that occur in the estuary have elevated the concentration of heavy metals in the area. Moreover, the increased of Pb and Cd in bottom sediment may due to land use changes in Kuala Selangor in 19th century such as mining activities, land clearing for development, industrial and aquaculture and agriculture activities. Besides that, most of the stations in Section 3 showed high inventories of Pb, Cd and Ni which may due to active industrial, agricultural and aquacultural activities along the Sungai Selangor and Kuala Selangor coastal area and also high sedimentation rate in the area. The external hazard index (H_{ex}) in all location is lower than the permissible value which is 1 and the I_{geo} values have indicated that the quality of sediment in Section 1 and Section 2 was not polluted as compared to Section 3 and Section 4.

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CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION

Coastal area is the area where the land and sea are meet together. Coastal area is susceptible to various environmental problem which defined as any physical, chemical, or biological environmental problems. These environmental problems include major component in environment that when changed by human or other activities, can result in degradation to natural resources (Cooperative Research Centre for Coastal Zone, Estuaries and Waterway Management, 2004). Coastal and estuarine region are among the important places for human inhabitant and they are often the ultimate receptacles of anthropogenic pollutants (Pan and Wang, 2012). Many persistent pollutants are sinks in that area and they accumulate in organism and bottom sediments (Selvaraj et al., 2004). They are not chemically or biologically degraded; thus the pollutant stays for longer period in the environment (Kamaruzzaman et al., 2011).

The input of pollutants into coastal areas from various sources can result in deleterious effects on wildlife habitats, degradation of the ecosystem and possible poisoning of human. The pollutants which contain toxic chemicals and metals are heavily accumulate in sediments as a sink, or be release from sediments and acting as a source back to overlying water via natural or anthropogenic disturbance (Pan and Wang, 2012).

Over the past few decades, the term "heavy metals" has been widely used. It is often used as a group name for metals and semimetals (metalloids) that have been associated with contamination and potential toxicity or eco-toxicity (Duffus, 2002). According to Keepax et al (2011), the term heavy metal actually referred to the stable metals of density greater than 5 – 6 gcm^{-3}. These include cadmium (Cd), cooper (Cu), lead (Pb), mercury (Hg), nickel (Ni), zinc (Zn) and metalloid arsenic. Heavy metals find their way into soils by deposition from the atmosphere, seepage, in groundwater from waste sites, direct application of fertilizers and sewage sludge. The concentration and the particular form of